Animal Heroes: Being the Histories of a Cat, a Dog, a Pigeon, a Lynx, two Wolves, and a Reindeer. By Ernest Thompson Seton. Fourth impression. Pp. 363. (London: Constable and Co., Ltd., 1920.) Price 8*s.* 6*d.* net.

THIS lively and generously illustrated book begins with the story of four of the lives of a "Royal Analostan" cat—we were a little afraid that there were to be nine—which, in virtue of considerable worldly wisdom, got on well against heavy odds. "But in spite of her prosperity, her social position, her royal name and fake pedigree, the greatest pleasure in her life is to slip out and go a-slumming in the gloaming, for now, as in her previous lives, she is at heart, and likely to be, nothing but a dirty little Slum Cat." The second story tells of the ability of a homing pigeon and of its successful education. "The hardest of all work is over the sea, for there is no chance of aid from landmarks; and the hardest of all times at sea is in fog, for then even the sun is blotted out and there is nothing whatever for guidance. With memory, sight, and hearing unavailable, the Homer has one thing left, and herein is his great strength, the inborn sense of direction. There is only one thing that can destroy this, and that is *fear,* hence the necessity of a stout little heart between these noble wings." This is a fair sample of the more reflective passages in the book, and it is too easy-going. There is a stronger note in the two descriptive studies of wolves, for Mr. Thompson Seton excels in proportion to the wildness of the scenery and of the *dramatis personae.* The other subjects are "The Boy and the Lynx," "The History of a Jack-Rabbit," "The Story of a Bull-Terrier," and "The White Reindeer." The author is an artist in reading the man into the beast—a great art, but a dangerous one; and we are afraid that some of the book is in the danger zone. But those who recoil from "apsychic" biology will probably agree that Mr. Thompson Seton's anthropomorphic faults lean to virtue's side.

The Year-book of the Scientific and Learned Societies of Great Britain and Ireland. Thirty-sixth Annual Issue. Pp. viii + 336. (London: C. Griffin and Co., Ltd., 1919.) Price 12*s.* 6*d.* net.

As is well known, this invaluable year-book gives official particulars and records of work not only of scientific societies in the British Isles, but also of such institutions as the Imperial Institute, Meteorological Office, National Physical Laboratory, Rothamsted Experimental Station, etc. Titles are given of papers read during the session 1918–19, and twenty-six new societies have been added to the comprehensive list of those surveyed in this volume. The work is one which we continually consult, and it is an essential volume for the reference library of every newspaper, institution, college, or club which desires to provide its staff or members with accurate particulars of the officers and activities of scientific organisations throughout the kingdom.

Letters to the Editor.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Weather Forecasts and Meteorology.

THE experience gained during the last few years in aerial navigation has shown, among other things, that weather forecasts, in these latitudes at any rate, are trustworthy only for a few hours in advance, and not always that.

If weather forecasting were at all accurate for a day or two ahead, it would be possible to make a correct weather-chart for to-morrow from the information received to-day. This has never yet been done, and it seems unlikely that it ever can be done, for the simple reason that in latitudes higher than 30° or thereabouts the conditions of the flow of the air are those of the permanent instability which characterises a stream exposed to the influence of surface friction at a velocity greater than that compatible with lamellar flow.

The unstable motion referred to consists of eddying motion superposed on a general drift, the eddies themselves being of all sizes and in all stages of growth and decay—some showing actual rotation, others being merely distinguishable by differences of velocity and direction. Eddies, when formed, have a certain individual life, generally of not many hours' duration, though in some cases there may be maintaining causes which will prolong their existence for days. The deviations of their courses (*i.e.* the path of their centres) from the average direction of the stream depend chiefly on the state and intensity of the other eddies in the neighbourhood, and, within wide limits, must be treated as a matter of pure chance.

Let anyone watch the motes of dust in the air illuminated by a beam of sunlight passing through a slit. They may all, on the whole, be drifting in some one direction, but combined with the general drift there will be irregular eddying motions, some quick, some slow, but deviating largely from the average for the whole. Much the same sort of thing on a large scale takes place in the atmosphere, and a weather forecast professes to determine from the motion over a certain area and at a certain time, together with the then existing variations, what the future motions will be.

For a time so short that the eddying motions preserve their respective characters this can be done, but not for longer periods, the causes which alter existing eddies and develop new ones being incalculable.

If the weather prophet makes no observations whatever, but is content to say that "to-morrow will be like to-day," he will be right rather more than sixty times out of a hundred. With all the information which can be obtained, by telegraph or otherwise, he may add 10 or 15 per cent. to his correct predictions for twenty-four hours ahead.

The Meteorological Office, I believe, claims rather a better average than this, but its forecasts are often so vague (*e.g.* "Wind moderate, strong to a gale at times in places. Fair, but with some cloud and rain. Temperature moderate") that almost any sort of weather might be said to fulfil the prediction.

The proper test of the value of forecasts for a day in advance would be to prepare a chart for that day and to publish it side by side with one formed from

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the actual data when they come to hand. A comparison of the two would soon show that weather prediction for more than a few hours ahead was impossible in present conditions.

While, however, long forecasts are, for the most part, mere untrustworthy guesswork, there are many meteorological subjects now neglected which might be investigated with success, but concerning which at present practically nothing is known. Such are the origin of the variation of electric potential in the air, the origin of thunderstorms and lightning, the coalescence or non-coalescence of cloud particles, the origin of hail and the causes which determine the shape and size of snow crystals or the volume of raindrops, the forms of clouds, and many others. Also there are more general questions still to be answered concerning trade winds and the circulation in equatorial regions. All investigations on these subjects should include the proper scales of comparison and attempts to produce corresponding phenomena on a small scale.

A. MALLOCK.

New University Club, June 28.

The Rate of Ascent of Pilot-Balloons.

IN NATURE for June 17 Dr. van Bemmelen directs attention to the excess rate of rising which pilot-balloons often show in the first few minutes of their ascent, and refers to two explanations of this phenomenon which have been put forward. These are that the rapid rising may be due (1) to turbulence in the lower layers of air or (2) to the tendency of balloons to be drawn into rising columns of air and thus to partake of their upward motion. The curves reproduced by Dr. van Bemmelen, which indicate the relation between rising velocity and height under different conditions, are of great interest, and show that the effect is not found when working on a small island in the Java Sea.

As double-theodolite observations over a sea exposure are not numerous, it may be of interest to refer to the results obtained by Capt. C. J. P. Cave and the present writer in some ascents made from the Scilly Islands during two winter months, November and December, some years ago. Particulars have recently been published by the Meteorological Office in Geophysical Memoir No. 14. The mean rate of ascent of the balloons used was found to be 160 metres per minute. Mean departures from this value for each minute of the ascent measured from the start are shown in Fig. 1. Dr. van Bemmelen's diagrams for the Thousand Islands and Batavia (0–3 p.m.) are also reproduced for comparison. It will be seen at once that the rate of ascent at Scilly, like that at the Thousand Islands, shows no excess above the normal in the first kilometre of height; if anything, the effect is slightly the other way.

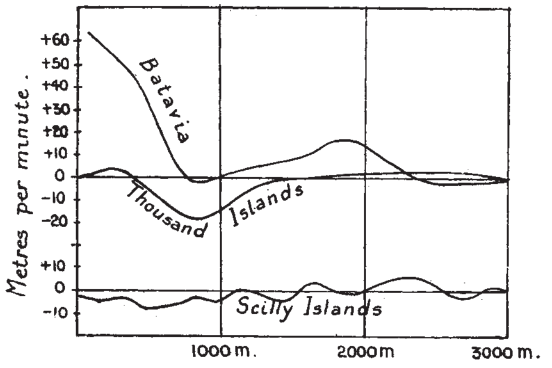

FIG. 1.

Ascents in the Scilly Islands are of particular interest in this connection. The area of the islands is so small that no convection effects due to solar heating would be expected, at any rate in the winter. On the other hand, the group contains a great number of small islands of a rocky and hilly nature, and these are spread over an area of some ten miles by five. They might naturally be expected to produce some turbulence in the air passing over them, and such turbulence is, in fact, shown by the records of the pressure-tube anemometer on St. Mary's, the largest of the islands. If the excess rate of rising so frequently noticed in the first kilometre over land is due to turbulence, as suggested by Wenger, we should expect to find it in the Scilly ascents; if it is due to convection currents caused by solar heating, we should not expect to find it. The evidence afforded by this example seems clear.

J. S. DINES.

66 Sydney Street, S.W.3, June 22.

Diamagnetism and the Structure of the Hydrogen Molecule.

IN a letter to NATURE of June 24 (p. 516) Dr. J. R. Ashworth has pointed out a possible origin of the diamagnetism of hydrogen by assuming oscillations or rotations of Bohr's paramagnetic hydrogen atom or molecule. Granted that such motions tend towards a diamagnetic effect, it is important to examine the plausibility of such a view in the light of recent experimental data. We know that:

(1) The specific susceptibility (χ_H) of *gaseous hydrogen at* 16° *C.* is $-19{\cdot}8(2) \times 10^{-7} \pm 0{\cdot}15 \times 10^{-7}$, with a mean error of 0·76 per cent. (Také Soné, Science Reports, Tôhoku, vol. viii., p. 115, 1919). *No variation of this, within the limits of experiment, could be detected over a pressure range of* 1 *to* 68 *atmospheres.*

(2) The value of χ_H for *liquid hydrogen at a temperature less than* $-253°$ *C.* is -27×10^{-7} (Onnes and Perrier, Proc. Amsterdam Acad., vol. xiv., p. 121, 1911).

(3) The value of χ_H for atomic hydrogen in various types of chemical combination, as deduced from the additive law of atomic diamagnetism for the hydrocarbons, is $-30{\cdot}5 \times 10^{-7}$ (Pascal, *Ann. de Chim. et de Phys.*, vol. xix., p. 5, 1910).

(4) There is no definite evidence that the diamagnetic susceptibility varies simply with temperature over a range $-180°$ C. to 20° C. Such small variations as do occur never change the sign of χ (except in the case of tin), and are attributable to changes of molecular grouping, *e.g.* crystallisation or aggregation (Ishiwara, Science Reports, Tôhoku, vol. iii., p. 303, 1914; A. E. Oxley, Phil. Trans. Roy. Soc., vol. ccxiv., A, p. 109, 1914).

(5) The theory of molecular rotation developed by Honda and Okubo (Science Reports, Tôhoku, vol. vii., p. 141, 1918), which is similar to that proposed by Dr. Ashworth, accounts for the diamagnetism of hydrogen and helium only if we suppose molecular rotations of angular velocity $6{\cdot}54 \times 10^{14}\,\text{sec}^{-1}$ and $3{\cdot}80 \times 10^{15}\,\text{sec}^{-1}$ respectively. In the case of the paramagnetic oxygen molecule it is necessary to suppose that *there is no rotation whatsoever* in order to obtain

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